

# ISOMETER® isoMIL425

Insulation monitoring device for unearthed AC-, AC/DC and DC systems in military applications up to 3(N)AC, AC/DC 400 V



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## Device features

- Monitoring of the insulation resistance  $R_f$  (R mode) or of the insulation impedance  $Z_f$  (Z mode) for unearthed 3(N)AC, AC and DC systems with galvanically connected rectifiers or frequency converters
- Insulation impedance  $Z_f$  (Z mode) for 50 Hz or 60 Hz
- Measuring the system voltage  $U_n$  (True-RMS) with undervoltage/overvoltage detection
- Measuring the DC residual voltages  $U_{L1e}$  (L1/+ to PE) and  $U_{L2e}$  (L2/- to PE)
- Selectable start-up delay, response delay and delay on release
- Alarm output via LEDs ("AL1", "AL2"), display, and alarm relays ("K1", "K2")
- Automatic device self test with connection monitoring
- Selectable n/c or n/o relay operation
- Measured value indication via multi-functional LC display
- Activatable fault memory
- Automatic adjustment to the system leakage capacitance  $C_e$  up to 300  $\mu\text{F}$  in R mode and 1  $\mu\text{F}$  in Z mode
- Two separately adjustable response value ranges 1...990 k $\Omega$  (prewarning, alarm)
- Password protection against unauthorised changing of parameters
- RS-485 (galvanically isolated) including the following protocols:
  - BMS (Bender measuring device interface) for the data exchange with other Bender devices
  - Modbus RTU
  - IsoData (for continuous data output)

## Intended use

The ISOMETER® monitors the insulation resistance  $R_f$  (R mode) or the insulation impedance (Z mode) of unearthed AC/DC main circuits (IT systems) with nominal system voltages of 3(N)AC, AC, AC/DC or DC 0...400 V, 15...460 Hz.

DC components existing in 3(N)AC, AC/DC systems do not influence the operating characteristics when a minimum load current of DC 10 mA flows. The separate supply voltage  $U_s$  allows de-energised systems to be monitored as well.

The maximum permissible system leakage capacitance is 300  $\mu\text{F}$  in R mode and 1  $\mu\text{F}$  in Z mode.

In order to meet the requirements of the applicable standards, customised parameter settings must be made on the equipment in order to adapt it to local equipment and operating conditions. Please heed the limits of the range of application indicated in the technical data.

Any other use or a use that goes beyond this constitutes improper use.

- i** To ensure that the ISOMETER® functions correctly, an internal resistance of  $\leq 1$  k $\Omega$  must exist between L1/+ and L2/- via the source (e.g. PSU) or the load.
- i** If the ISOMETER® is installed inside a control cabinet, the insulation fault message must be audible and/or visible to attract attention.

## Functional description

The ISOMETER® measures the insulation resistance  $R_f$  and the system leakage capacitance  $C_e$  between the system to be monitored (L1/+, L2/-) and earth (PE). Z mode (selectable in the "Set" menu) calculates the insulation impedance  $Z_f$  from  $R_f$  and  $C_e$  with a system frequency parameter  $f_n = 50$  Hz or  $f_n = 60$  Hz. The RMS value of the system voltage  $U_n$  between L1/+ and L2/- as well as the residual voltages  $U_{L1e}$  (between L1/+ and earth) and  $U_{L2e}$  (between L2/- and earth) are also measured.

Also from a minimum voltage, the ISOMETER® determines the insulation resistance  $R_{UGF}$  from the residual voltages  $U_{L1e}$  and  $U_{L2e}$ . It is an approximate value for one-sided insulation faults and can be used as a trend indicator in cases where the ISOMETER® has to adapt to an  $R_f$  and  $C_e$  relation that varies considerably.

The detected fault is assignable to an alarm relay via the menu. If the values  $R_f$ ,  $Z_f$  or  $U_n$  violate the response values activated in the "AL" menu, this will be indicated by the LEDs and relays "K1" and "K2" according to the signalling assignment set in the "out" menu. In addition, the menu offers the setting of the relay operation and the activation of the fault memory "M".

If the values  $R_f$ ,  $Z_f$  or  $U_n$  do not violate their release value (response value plus hysteresis) for the period  $t_{off}$  without interruption, the alarm relays will switch back to their initial position and the alarm LEDs stop lighting. If the fault memory is activated, the alarm relays remain in alarm position and the LEDs are lit until the reset key "R" is pressed or the supply voltage  $U_s$  is interrupted.

The device function can be checked with the test button "T".

Parameters are assigned to the device via the LCD and the control buttons on the front panel; this function can be password-protected. Parameterisation is also possible via the BMS bus.

**Connection**

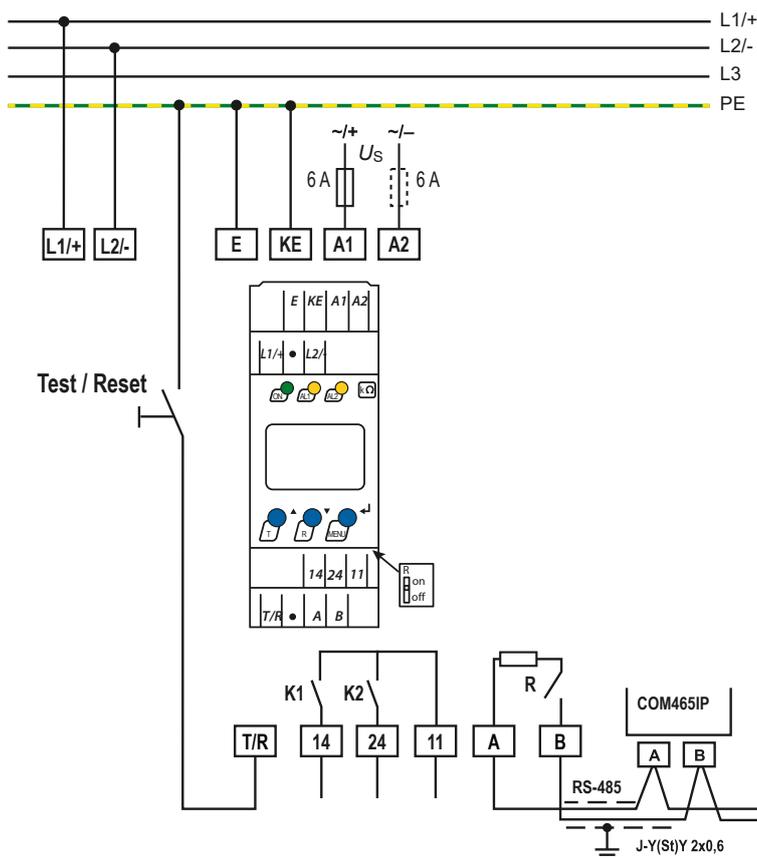
**i For UL applications:**

Only use 60/75 °C copper lines.

For UL and CSA applications: Connect the supply voltage via 5 A fuses.

For details about the conductor cross sections required for wiring, refer to chapter Technical data.

**Wiring diagram**



Terminal	Connections
<b>A1, A2</b>	Connection to the supply voltage $U_s$ via fuse (line protection): If supplied from an IT system, protect both lines by a fuse.
<b>E, KE</b>	Connect each terminal separately to PE: Use same wire cross section as for "A1", "A2".
<b>L1/+, L2/-</b>	Connection to the system to be monitored
<b>T/R</b>	Connection for the external combined test and reset button
<b>11, 14</b>	Connection to alarm relay "K1"
<b>11, 24</b>	Connection to alarm relay "K2"
<b>A, B</b>	RS-485 communication interface with connectable terminating resistor Example: Connection of a BMS Ethernet gateway COM465IP

## Technical data isoMIL425

()\* = factory setting

### Insulation coordination acc. to IEC 60664-1/-3

#### Definitions

Measuring circuit (IC1)	L1/+, L2/-
Supply circuit (IC2)	A1, A2
Output circuit (IC3)	11, 14, 24
Control circuit (IC4)	E, KE, T/R, A, B

Rated voltage 400 V

Overvoltage category III

#### Rated impulse voltage

IC1/(IC2-4)	6 kV
IC2/(IC3-4)	4 kV
IC3/(IC4)	4 kV

#### Rated insulation voltage

IC1/(IC2-4)	400 V
IC2/(IC3-4)	250 V
IC3/(IC4)	250 V

Pollution degree 3

#### Protective separation (reinforced insulation) between

IC1/(IC2-4)	Overvoltage category III, 600 V
IC2/(IC3-4)	Overvoltage category III, 300 V
IC3/(IC4)	Overvoltage category III, 300 V

#### Voltage test (routine test) according to IEC 61010-1

IC2/(IC3-4)	AC 2.2 kV
IC3/(IC4)	AC 2.2 kV

#### Supply voltage

Supply voltage $U_s$	AC 100...240 V DC 24...240 V
Tolerance of $U_s$	-30...+15 %
Frequency range of $U_s$	47...63 Hz
Power consumption	$\leq 3$ W, $\leq 9$ VA

#### Monitored IT system

Nominal system voltage $U_n$	3(N)AC, AC/DC 0...400 V
Tolerance of $U_n$	+25 %
Frequency range of $U_n$	DC, 15...460 Hz

### Measuring circuit

Measuring voltage $U_m$	$\pm 12$ V
Measuring current $I_m$ at $R_F, Z_F = 0 \Omega$	$\leq 110 \mu\text{A}$
Internal resistance $R_i, Z_i$	$\geq 115$ k $\Omega$
Permissible system leakage capacitance $C_e$	R mode: $\leq 300 \mu\text{F}$ Z mode: $\leq 1 \mu\text{F}$
Permissible extraneous DC voltage $U_{ig}$	$\leq 700$ V

### Response values

Response value $R_{an1}$	2...990 k $\Omega$ (40 k $\Omega$ )*
Response value $R_{an2}$	1...980 k $\Omega$ (10 k $\Omega$ )*
Relative uncertainty $R_{an}$ (R mode or $Z_F \approx R_F$ )	$\pm 15$ %, at least $\pm 1$ k $\Omega$
Hysteresis $R_{an}$	25 %, at least 1 k $\Omega$
Response value $Z_{an1}$	11...500 k $\Omega$ (off)*
Response value $Z_{an2}$	10...490 k $\Omega$ (off)*
Relative uncertainty $Z_{an}$	$\pm 15$ %, at least $\pm 1$ k $\Omega$
Hysteresis $Z_{an}$	25 %, at least 1 k $\Omega$
Undervoltage detection	10...499 V (off)*
Overvoltage detection	11...500 V (off)*
Relative uncertainty $U$	$\pm 5$ %, at least $\pm 5$ V
Relative uncertainty depending on the frequency $\geq 400$ Hz	-0,015 %/Hz
Hysteresis $U$	5 %, at least 5 V

### Time response

Response time $t_{an}$ of $R_F = 0.5 \times R_{an}$ and $C_e = 1 \mu\text{F}$ acc. to IEC 61557-8	$\leq 10$ s
Response time $t_{an}$ of $Z_F = 0.5 \times Z_{an}$	$\leq 5$ s
Start-up delay $t$	0...10 s (0 s)*
Response delay $t_{on}$	0...99 s (0 s)*
Delay on release $t_{off}$	0...99 s (0 s)*

### Displays, memory

Display	LC display, multi-functional, not illuminated
Display range measured value insulation resistance ( $R_F$ )	1 k $\Omega$ ... 4 M $\Omega$
Display range measured value impedance ( $Z_F$ ) with $f_n = 50/60$ Hz	1 k $\Omega$ ... 1 M $\Omega$
Operating uncertainty $R_F$ in R mode, $Z_F$ in Z mode	$\pm 15$ %, at least $\pm 1$ k $\Omega$
Display range measured value system voltage ( $U_n$ )	0...500 V <sub>RMS</sub>
Operating uncertainty	$\pm 5$ %, at least $\pm 5$ V
Display range measured value system leakage capacitance of $R_F > 10$ k $\Omega$	0...300 $\mu\text{F}$
Operating uncertainty	$\pm 15$ %, at least $\pm 2 \mu\text{F}$
Display range measured value system leakage capacitance of $Z_F > 10$ k $\Omega$	1 nF ... 1 $\mu\text{F}$
Operating uncertainty ( $Z_F \approx X_C$ )	$\pm 15$ %, at least $\pm 2$ nF
Password	off / 0...999 (off, 0)*
Fault memory alarm messages	on / (off)*

## Interface

Interface; protocol	RS-485; BMS, Modbus RTU, isoData
Baud rate	BMS (9.6 kBit/s), Modbus RTU (selectable), isoData (115.2 kBit/s)
Cable length (9.6 kBit/s)	≤ 1200 m
Cable: twisted pairs, shield connected to PE on one side	min. J-Y(St)Y 2 × 0.6
Terminating resistor	120 Ω (0.25 W), internal, can be connected
Device address, BMS bus, Modbus RTU	3...90 (3)*

## Switching elements

Switching elements	2 × 1 n/o contacts, common terminal 11
Operating principle	n/c, n/o (n/o)*
Electrical endurance	10,000 cycles

### Contact data acc. to IEC 60947-5-1

Utilisation category	AC-12 / AC-14 / DC-12 / DC-12 / DC-12
Rated operational voltage	230 V / 230 V / 24 V / 110 V / 220 V
Rated operational current	5 A / 2 A / 1 A / 0.2 A / 0.1 A
Necessary minimum contact load	1 mA at AC/DC ≥ 10 V

## Environment/EMC

EMC	IEC 61326-2-4, DIN EN 50121-3-2
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### Ambient temperatures

Operation	-40...+70 °C
Transport	-50...+85 °C
Storage	-55...+80 °C

### Climatic class acc. to IEC 60721

Stationary use (IEC 60721-3-3)	3K24
Transport (IEC 60721-3-2)	2K11
Long-time storage (IEC 60721-3-1)	1K23

### Classification of mechanical conditions acc. to IEC 60721

Stationary use (IEC 60721-3-3)	3M12
Transport (IEC 60721-3-2)	2M4
Long-time storage (IEC 60721-3-1)	1M12

## Other

Operating mode	continuous operation
Mounting	cooling slots must be ventilated vertically
Degree of protection, built-in components (DIN EN 60529)	IP30
Degree of protection, terminals (DIN EN 60529)	IP20
Enclosure material	polycarbonate
DIN rail mounting acc. to	IEC 60715
Screw mounting	2 × M4 with mounting clip
Weight	≤ 150 g

## Connection

### Push-wire terminals

Nominal current	≤ 10 A
Conductor sizes	AWG 24...14
Stripping length	10 mm
Rigid	0.2...2.5 mm <sup>2</sup>
Flexible without ferrules	0.75...2.5 mm <sup>2</sup>
Flexible with ferrules with/without plastic sleeve	0.25...2.5 mm <sup>2</sup>
Multi-conductor flexible with TWIN ferrules with plastic sleeve	0.5...1.5 mm <sup>2</sup>
Opening force	50 N
Test opening	Ø 2.1 mm

## Standards and certifications

The ISOMETER® was developed in compliance with the following standards:

- DIN EN 61557-8 (VDE 0413-8): 2015-12/Cor1: 2016-12
- IEC 61557-8: 2014/COR1: 2016



## EU Declaration of Conformity

The EU Declaration of Conformity is available at the following Internet address:

[https://www.bender.de/fileadmin/content/Products/CE/CEKO\\_isoXX425.pdf](https://www.bender.de/fileadmin/content/Products/CE/CEKO_isoXX425.pdf)

## UKCA Declaration of Conformity

Die UKCA-Konformitätserklärung ist unter folgendem Link verfügbar:

[https://www.bender.de/fileadmin/content/Products/UKCA/UKCA\\_isoXX425.pdf](https://www.bender.de/fileadmin/content/Products/UKCA/UKCA_isoXX425.pdf)

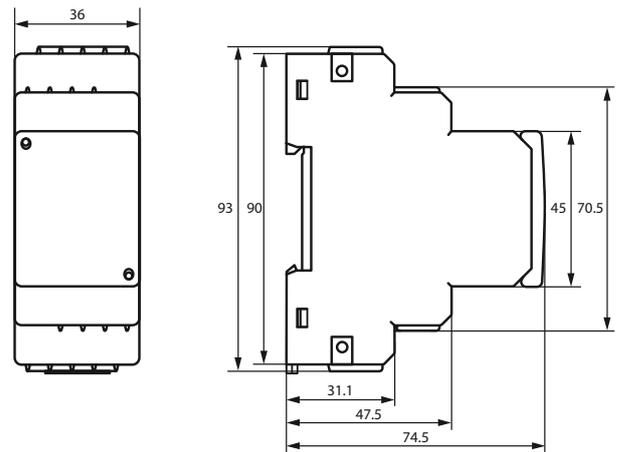
## Ordering data

Type	Supply voltage $U_s$	Article number	
		Push-wire terminals	Screw-type terminals
isoMIL425-D4W-4	AC 100...240 V; 47...63 Hz DC 24...240 V	B71036306W	–

## Accessories

Description	Article number
Mounting clip for screw mounting	B98060008

## Dimensions



Dimension diagram (in mm)



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Subject to change!  
The specified standards take into account the  
edition valid until 08.2024 unless otherwise  
indicated.